CLAIMS

What is claimed is:

1. A coating admixture, comprising:

(a) fluoroelastomer particulate derived from vinylidene-fluoride, hexafluoropropene, and tetrafluoroethylene, said fluoroelastomer having a Mooney viscosity from about 25 to about 75, fluorine from about 65 to about 69 atomic weight percent, at least 90 weight percent fluoroterpolymer, and halogenated crosslink sites;

(b) inert particulate from about 10 to about 50 parts per 100 parts by weight of said fluoroelastomer particulate, said inert particulate having particle sizes less than about 250 mesh;

(c) curing agent from about 0.5 to about 20 parts per 100 parts by weight of said fluoroelastomer particulate, wherein said curing agent crosslinks said fluoroelastomer particulate to generate cured fluoroelastomer and hydrogen ions; and

(d) metallic oxide reduction-agent particulate from about 5 to about 50 parts per 100 parts by weight of said fluoroelastomer particulate, said metallic oxide reduction-agent particulate having particle sizes less than about 250 mesh and a BET surface area from about 40 to about 70 square meters per gram.

2. A coating admixture according to Claim 1, further comprising polytetrafluorinated ethylene particulate of less than about 75 parts per 100 parts by weight of said fluoroelastomer particulate, said polytetrafluorinated ethylene particulate having a mean particle size from about 10 to about 50 microns.

3. A coating admixture according to Claim 1, further comprising a powdered metallic oxide selected from the group consisting of ferric oxide, titanium dioxide, and a mixture thereof, said powdered metallic oxide at a level of from about 5 to about 25 parts per 100 parts by weight of said fluoroelastomer particulate.

4. A coating admixture according to Claim 1, further comprising microspheres, at a level of from about 0.5 to about 20 parts per 100 parts by weight of said fluoroelastomer particulate.

5. A coating admixture according to Claim 1, further comprising a wax particulate in from about 0.05 parts to about 5 parts per 100 parts by weight of said fluoroelastomer particulate.

6. A coating admixture according to Claim 1, wherein said inert particulate is selected from the group consisting of calcium carbonate, carbon black, graphite, fumed silica, and kaolin and mixtures thereof.

7. A coating admixture according to Claim 1, wherein said curing agent comprises an amine.

8. A coating admixture according to Claim 7, wherein said amine curing agent is selected from the group consisting of n,n'-dicinnamylidene-1,6-hexene, hexamethylene diamine carbamate, ethylene diamine carbamate, and combinations thereof.

9. A coating admixture according to Claim 1, wherein said metallic oxide reduction-agent particulate comprises MgO from about 1 to about 30 parts per 100 parts by weight of said fluoroelastomer particulate.

10. A coating admixture according to Claim 9, wherein said metallic oxide reduction-agent particulate comprises ZnO from about 1 to about 20 parts per 100 parts by weight of said fluoroelastomer particulate.

11. A coating admixture according to Claim 1, further comprising solvent sufficient to provide an admixture viscosity from about 10,000 centipoises to about 500,000 centipoises.

12. A coating admixture according to Claim 11, wherein said solvent comprises a ketone, alcohol, or ester solvent or a mixture thereof.

13. A coating admixture according to Claim 12, wherein said solvent is selected from the group consisting of methyl isobutyl ketone, ethyl acetate, cellosolve acetate, sorbitol acetate, 3,5,5-trimethyl-3-cyclohexenene-1-one, cyclohexene-1-one, butyl cellulose acetate, ethanol, methanol, isopropanol, or a mixture thereof.

14. A coating admixture according to Claim 13, wherein said solvent comprises a blend of about 20 weight percent 3,5,5-trimethyl-3-cyclohexenene-1-one, about 20 weight percent cyclohexene-1-one, and about 60 weight percent butyl cellulose acetate.

15. A coating admixture according to Claim 1 wherein said inert particulate is carbon black, said curing agent is n,n'-dicinnamylidene-1,6-hexene, said reduction agent comprises MgO from about 1 to about 30 parts per 100 parts by weight of said fluoroelastomer particulate and a remainder of ZnO from about 1 to about 20 parts per 100 parts by weight of said fluoroelastomer particulate, and said admixing further comprises admixing:

(e) polytetrafluorinated ethylene particulate of less than about 75 parts per 100 parts by weight of said fluoroelastomer particulate, said polytetrafluorinated ethylene particulate having a mean particle size from about 10 to about 50 microns;

(f) wax particulate of from about 0.05 parts to about 5 parts per 100 parts by weight of said fluoroelastomer particulate; and

(g) solvent sufficient to provide an admixture viscosity from about 10,000 centipoises to about 500,000 centipoises, wherein said solvent comprises a blend of about 20 weight percent 3,5,5-trimethyl-3-cyclohexenene-1-one, about 20 weight percent cyclohexene-1-one, and about 60 weight percent butyl cellulose acetate.

16. A coating admixture according to Claim 15 wherein said carbon black is about 35 parts per 100 parts by weight of said fluoroelastomer particulate, said polytetrafluorinated ethylene particulate is about 5 parts per 100 parts by weight of said fluoroelastomer particulate, said n,n'-dicinnamylidene-1,6-hexene is about 8 parts per 100 parts by weight of said fluoroelastomer particulate, said MgO is about 9 parts per 100 parts by weight of said fluoroelastomer particulate, and said ZnO is about 10 parts per 100 parts by weight of said fluoroelastomer particulate.

17. A coating admixture according to Claim 15, further comprising a powdered metallic oxide selected from the group consisting of ferric oxide, titanium dioxide, and a mixture thereof, said powdered metallic oxide at a level of from about 5 to about 25 parts per 100 parts by weight of said fluoroelastomer particulate.

18. A coating admixture according to Claim 15, further comprising microspheres, said microspheres about 8 parts per 100 parts by weight of said fluoroelastomer particulate.

19. A coating admixture according to Claim 16, further comprising a powdered metallic oxide selected from the group consisting of ferric oxide, titanium dioxide, and a mixture thereof, said powdered metallic oxide at a level of from about 5 to about 25 parts per 100 parts by weight of said fluoroelastomer particulate.

20. A coating admixture according to Claim 16, further comprising microspheres, said microspheres about 8 parts per 100 parts by weight of said fluoroelastomer particulate.

21. A coating admixture according to Claim 19, further comprising microspheres, said microspheres about 8 parts per 100 parts by weight of said fluoroelastomer particulate.

22. A machine component covered with a cured coating applied to a surface of said component, said cured coating having a cured continuous elastomer phase derived from dispersed crosslinkable elastomer, said component comprising:

(a) a first coating region in said cured coating derived from a first admixture of said crosslinkable elastomer, said first coating region having a first coating thickness respective to said surface; and

(b) a second coating region in said cured coating derived from a second admixture of microspheres and said crosslinkable elastomer, said second coating region interbonded with said first coating region with said cured continuous elastomer phase, said second coating region having a second coating thickness respective to said surface which is greater than first coating thickness, said second coating admixture having dispersed microspheres;

wherein said cured continuous elastomer phase interbonding said first region and said second region is derived from simultaneous curing of said crosslinkable elastomer in both said regions.

23. A machine component according to Claim 22 wherein cured coating is derived from a coating admixture, comprising:

(1) fluoroelastomer particulate derived from vinylidene-fluoride, hexafluoropropene, and tetrafluoroethylene, said fluoroelastomer having a Mooney viscosity from about 25 to about 75, fluorine from about 65 to about 69 atomic weight percent, at least 90 weight percent fluoroterpolymer, and halogenated crosslink sites;

(2) inert particulate from about 10 to about 50 parts per 100 parts by weight of said fluoroelastomer particulate, said inert particulate having particle sizes less than about 250 mesh;

(3) curing agent from about 0.5 to about 20 parts per 100 parts by weight of said fluoroelastomer particulate, wherein said curing agent crosslinks said fluoroelastomer particulate to generate cured fluoroelastomer and hydrogen ions; and

(4) metallic oxide reduction-agent particulate from about 5 to about 50 parts per 100 parts by weight of said fluoroelastomer particulate, said metallic oxide reduction-agent particulate having particle sizes less than about 250 mesh and a BET surface area from about 40 to about 70 square meters per gram.

24. A machine component according to Claim 22 wherein said machine component is a head gasket for an internal combustion engine.

25. A machine component according to Claim 23 wherein said machine component is a head gasket for an internal combustion engine.

26. A machine component according to Claim 22 having a recessed portion in said component surface, said recessed portion positioned at a location for compressively interfacing said component to a second component, wherein said second coating region fills said recessed portion and said second admixture has a sufficient quantity of said microspheres for providing, upon expansion of said microspheres and curing of said second region coating, an elevated compressible foam above said recessed portion, said elevated foam having an upper foam surface extending, respective to said component surface, above said first coating thickness to be generally concave to said component surface.

27. A machine component according to Claim 23 having a recessed portion in said component surface, said recessed portion positioned at a location for compressively interfacing said component to a second component, wherein said second coating region fills said recessed portion and said second admixture has a sufficient quantity of said micro-spheres for providing, upon expansion of said micro-spheres and curing of said second region coating, an elevated compressible foam above said recessed portion, said elevated foam having an upper foam surface extending, respective to said component surface, above said first coating thickness to be generally concave to said component surface.

28. A machine component according to Claim 26 wherein said machine component is a head gasket for an internal combustion engine.

29. A machine component according to Claim 27 wherein said machine component is a head gasket for an internal combustion engine.

30. A machine component according to Claim 22 wherein a plurality of said first coating regions are in said cured coating, said first regions positioned at locations for compressively interfacing said machine component to a second component through use of at least one mechanical fastener connected in each first coating region; and at least one said second coating region is in said coating, each second coating region positioned for compressively interfacing said machine component to said second component via coplanar mechanical compression derived from said fasteners, wherein said second admixture has a sufficient quantity of said micro-spheres for providing, upon expansion of said micro-spheres and curing of said second coating region, an elevated compressible foam with a thickness enabling a compressive seal between said second coating region and said second component.

31. A machine component according to Claim 23, further comprising:

(c) a plurality of said first coating regions in said cured coating, said first regions positioned at locations for compressively interfacing said machine component to a second component through use of at least one mechanical fastener connected in each first coating region; and

(d) at least one said second coating region in said coating, each second coating region positioned for compressively interfacing said machine component to said second component via coplanar mechanical compression derived from said fasteners, wherein said second admixture has a sufficient quantity of said micro-spheres for providing, upon expansion of said micro-spheres and curing of said second coating region, an elevated compressible foam with a thickness enabling a compressive seal between said second coating region and said second component.

32. A machine component according to Claim 30 wherein said machine component is a head gasket for an internal combustion engine.

33. A machine component according to Claim 31 wherein said machine component is a head gasket for an internal combustion engine.

34. A gasket, comprising:

(a) an essentially rigid carrier; and

(b) a cured coating applied to at least one surface of said carrier, said coating cured from a coating admixture of:

(1) fluoroelastomer particulate derived from vinylidene-fluoride, hexafluoropropene, and tetrafluoroethylene, said fluoroelastomer having a Mooney viscosity from about 25 to about 75, fluorine from about 65 to about 69 atomic weight percent, at least 90 weight percent fluoroterpolymer, and halogenated crosslink sites;

(2) inert particulate from about 10 to about 50 parts per 100 parts by weight of said fluoroelastomer particulate, said inert particulate having particle sizes less than about 250 mesh;

(3) curing agent from about 0.5 to about 20 parts per 100 parts by weight of said fluoroelastomer particulate, wherein said curing agent crosslinks said fluoroelastomer particulate to generate cured fluoroelastomer and hydrogen ions; and

(4) metallic oxide reduction-agent particulate from about 5 to about 50 parts per 100 parts by weight of said fluoroelastomer particulate, said metallic oxide reduction-agent particulate having particle sizes less than about 250 mesh and a BET surface area from about 40 to about 70 square meters per gram.

35. A gasket according to Claim 34 wherein said admixture further comprises polytetrafluorinated ethylene particulate of less than about 75 parts per 100 parts by weight of said fluoroelastomer particulate, said polytetrafluorinated ethylene particulate having a mean particle size from about 10 to about 50 microns.

36. A gasket according to Claim 34 wherein said admixture further comprises a powdered metallic oxide selected from the group consisting of ferric oxide, titanium dioxide, and a mixture thereof, said powdered metallic oxide at a level of from about 5 to about 25 parts per 100 parts by weight of said fluoroelastomer particulate.

37. A gasket according to Claim 34 wherein said admixture further comprises microspheres, said microspheres from about 0.5 to about 20 parts per 100 parts by weight of said fluoroelastomer particulate.

38. A gasket according to Claim 34 wherein said admixture further comprises a wax particulate, said wax particulate from about .05 parts to about 5 parts per 100 parts by weight of said fluoroelastomer particulate.

39. A gasket according to Claim 34 wherein said admixture further comprises solvent sufficient to provide an admixture viscosity from about 10,000 centipoises to about 500,000 centipoises.

40. A gasket according to Claim 34 wherein said inert particulate is carbon black, said curing agent is n,n'-dicinnamylidene-1,6-hexene, said reduction agent comprises MgO from about 1 to about 30 parts per 100 parts by weight of said fluoroelastomer particulate and a remainder of ZnO from about 1 to about 20 parts per 100 parts by weight of said fluoroelastomer particulate, and said admixing further comprises admixing:

(5) polytetrafluorinated ethylene particulate of less than about 75 parts per 100 parts by weight of said fluoroelastomer particulate, said polytetrafluorinated ethylene particulate having a mean particle size from about 10 to about 50 microns;

(6) wax particulate of from about .05 parts to about 5 parts per 100 parts by weight of said fluoroelastomer particulate; and

(7) solvent sufficient to provide an admixture viscosity from about 10,000 centipoises to about 500,000 centipoises, wherein said solvent comprises a blend of about 20 weight percent 3,5,5-trimethyl-3-cyclohexenene-1-one, about 20 weight percent cyclohexene-1-one, and about 60 weight percent butyl cellulose acetate.

41. A gasket, comprising:

(a) an essentially rigid carrier; and

(b) a cured coating applied to at least one surface of said carrier, said coating cured having a cured continuous elastomer phase derived from dispersed crosslinkable elastomer, said cured coating having:

(1) a first coating region in said cured coating derived from a first admixture of said crosslinkable elastomer, said first coating region having a first coating thickness respective to said surface; and

(2) a second coating region in said cured coating derived from a second admixture of microspheres and said crosslinkable elastomer, said second coating region interbonded with said first coating region with said cured continuous elastomer phase, said second coating region having second coating thickness respective to said surface which is greater than first coating thickness, said second coating admixture having dispersed microspheres;

wherein said cured continuous elastomer phase interbonding said first region and said second region is derived from simultaneous curing of said crosslinkable elastomer in both said regions.

42. A gasket according to Claim 41 wherein cured coating is derived from a coating admixture, comprising:

(1) fluoroelastomer particulate derived from vinylidene-fluoride, hexafluoroproplene, and tetrafluoroethylene, said fluoroelastomer having a Mooney viscosity from about 25 to about 75, fluorine from about 65 to about 69 atomic weight percent, at least 90 weight percent fluoroterpolymer, and halogenated crosslink sites;

(2) inert particulate from about 10 to about 50 parts per 100 parts by weight of said fluoroelastomer particulate, said inert particulate having particle sizes less than about 250 mesh;

(3) curing agent from about 0.5 to about 20 parts per 100 parts by weight of said fluoroelastomer particulate, wherein said curing agent crosslinks said fluoroelastomer particulate to generate cured fluoroelastomer and hydrogen ions; and

(4) metallic oxide reduction-agent particulate from about 5 to about 50 parts per 100 parts by weight of said fluoroelastomer particulate, said metallic oxide reduction-agent particulate having particle sizes less than about 250 mesh and a BET surface area from about 40 to about 70 square meters per gram.

43. A gasket according to Claim 41 wherein said gasket is a head gasket for an internal combustion engine.

44. A gasket according to Claim 41 having a recessed portion in said surface, said recessed portion positioned at a location for compressively interfacing said gasket to a component, wherein said second coating region fills said recessed portion and said second admixture has a sufficient quantity of said micro-spheres for providing, upon expansion of said micro-spheres and curing of said second region coating, an elevated compressible foam above said recessed portion, said elevated foam having an upper foam surface extending, respective to said surface, above said first coating thickness to be generally concave to said surface.

45. A gasket according to Claim 44 wherein said gasket is a head gasket for an internal combustion engine.

46. A gasket according to Claim 41 wherein a plurality of said first coating regions are in said cured coating, said first regions positioned at locations for compressively interfacing said gasket between two components through use of at least one mechanical fastener connected in each first coating region; and each said second coating region is positioned for compressively interfacing said gasket to said components via coplanar mechanical compression derived from said fasteners, wherein said second admixture has a sufficient quantity of said micro-spheres for providing, upon expansion of said micro-spheres and curing of said second coating region, an elevated compressible foam with a thickness enabling a compressive seal between said second coating region and one of said components.

47. A gasket according to Claim 46 wherein said gasket is a head gasket for an internal combustion engine.

48. A method for making a gasket, comprising:

(a) admixing a fluoroelastomer coating admixture;

(b) applying said admixture through a very fine screen to coat an essentially rigid metal carrier having a non-planar surface with a layer of said admixture, said layer having a thickness controlled to essentially preclude flow of admixture laterally along said surface;

(c) drying said admixture;

(d) repeating said printing and drying steps until a desired thickness of a plurality of said dried admixture layers is achieved; and

(e) curing said dried admixture layers simultaneously.

49. A method according to Claim 48 wherein said applying uses screen printing.

50. A method according to Claim 49 wherein said screen has a mesh which will pass particles of no greater size than 110 mesh.

51. A method according to Claim 48 wherein said fluoroelastomer is admixed from:

(1) fluoroelastomer particulate derived from vinylidene-fluoride, hexafluoropropene, and tetrafluoroethylene, said fluoroelastomer having a Mooney viscosity from about 25 to about 75, fluorine from about 65 to about 69 atomic weight percent, at least 90 weight percent fluoroterpolymer, and halogenated crosslink sites;

(2) inert particulate from about 10 to about 50 parts per 100 parts by weight of said fluoroelastomer particulate, said inert particulate having particle sizes less than about 250 mesh;

(3) curing agent from about 0.5 to about 20 parts per 100 parts by weight of said fluoroelastomer particulate, wherein said curing agent crosslinks said fluoroelastomer particulate to generate cured fluoroelastomer and hydrogen ions; and

(4) metallic oxide reduction-agent particulate from about 5 to about 50 parts per 100 parts by weight of said fluoroelastomer particulate, said metallic oxide reduction-agent particulate having particle sizes less than about 250 mesh and a BET surface area from about 40 to about 70 square meters per gram.

52. A machine component covered with a cured coating applied to a surface of said component, said cured coating having a cured continuous elastomer phase derived from dispersed crosslinkable elastomer, said component comprising:

(a) a polymeric bead bonded to a portion of said component surface, said polymeric bead having a concentration of from about 5 to about 25 parts per 100 parts by weight of reinforcing particulate selected from the group consisting of metallic particulate, metallic oxide particulate, and combinations thereof wherein said bead has a first surface bonded to said component surface, a second surface free of bonding connection to said component surface, and a first maximum bead thickness respective to said component surface;

(b) a first coating region in said cured coating derived from a first admixture of said crosslinkable elastomer, said first coating region having a portion bonded to said surface with a first coating thickness respective to said surface, said first coating region having a bead enclosing portion bonded to said second surface of said polymeric bead so that said polymeric bead is encapsulated within a peripheral boundary defined by said component surface and said bead enclosing portion of said first coating region, said first coating having a crest thickness at said first maximum bead thickness, and said encapsulated polymeric bead and said bead enclosing portion of said first coating region defining a second maximum bead thickness as a sum of said first maximum bead thickness and said crest thickness; and

(c) a second coating region in said cured coating derived from a second admixture of microspheres and said crosslinkable elastomer, said second coating admixture

having dispersed microspheres, said second coating region interbonded with said first coating region with said cured continuous elastomer phase;

wherein said second coating region has a maximum second coating thickness respective to said surface which is greater than said second maximum bead thickness, and wherein said cured continuous elastomer phase interbonding said first region and said second region is derived from simultaneous curing of said crosslinkable elastomer in both said regions.